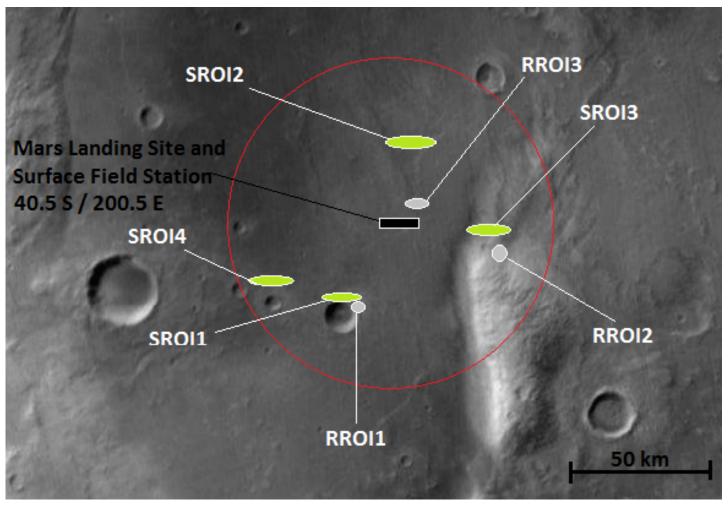
EXPLORATION ZONE IN THE NEWTON CRATER Workshop Abstract #1015

LAINE P.E. UNIVERSITY OF JYVASKYLA,
FINLAND

Exploration Zone Map



1st EZ Workshop for Human Missions to Mars



Science ROI(s) Rubric



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				Site Factors	SR011	SR012	SROI3	SR014	RR011	RR012	RROI3	EZ SUM	
	oic	Threshold	J/OR	Potential for past habitability	0	•	•	0	0	•	0	3,4	
	Astrobio	Timesiloid	ANE	Potential for present habitability/refugia	•	0	0	0	•	0	0	2,5	
	As	Qualifying		Potential for organic matter, w/ surface exposure	0	0	0	0	0	0	0	0,7	
	Science	Threshold		loachian/Hesperian rocks w/ trapped atmospheric gases	0	0	0	0	0	0	0	0,7	
	Scie			Meteorological diversity in space and time	•	•	•	•	•	•	•	7,0	
_	neric			High likelihood of surface-atmosphere exchange	•	0	0	0	•	0	0	2,5	
Criteria	Atmospheric			Amazonian subsurface or high-latitude ice or sediment	•	0	0	0	•	0	0	2,5	
Crit	Atm			High likelihood of active trace gas sources	•	?	?	0	•	?	?	2,1	
Site (Range of martian geologic time; datable surfaces	•	•	•	•	•	•	•	7,0	
		Threshold		Evidence of aqueous processes	•	•	•	0	•	•	•	6,1	
Science				Potential for interpreting relative ages	•	•	•	•	•	•	•	7,0	
Scie	e			Igneous Rocks tied to 1+ provinces or different times	?	?	?	?	?	?	?		
•	cien			Near-surface ice, glacial or permafrost	•	0	0	0	•	0	0	2,5	
	Geoscience			Noachian or pre-Noachian bedrock units	0	0	0	0	0	0	0	0,7	
		Qualifying		Outcrops with remnant magnetization	?	?	?	?	?	?	?		
				Primary, secondary, and basin-forming impact deposits	•			•	•			3,0	
				Structural features with regional or global context	•				•			2,0	
				Diversity of aeolian sediments and/or landforms		•	•	0		•	0	3,2	

Key							
Yes							
0	Partial Support or Debated						
	No						
?	Indeterminate						

Resource ROI(s) Rubric



W	orl/	ksho	p for	Hu	man	ıМ	iss	ions	to	N	lars
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			Site Factors	SROI	SROI	SROI	SROI	RROI	RROI	RROI	EZ SU
	En	gineering	Meets First Order Criteria (Latitude, Elevation, Thermal Inertia)	•	•	•	•	•	•	•	7,0
			Potential for ice or ice/regolith mix	•	0	0	0	•	0	0	2,5
			Potential for ice or ice/regolith mix Potential for hydrated minerals	•	0	0	0	•	0	0	2,5
	r Resource	Threshold	Quantity for substantial production	•	0	0	0	•	0	0	2,5
			Potential to be minable by highly automated systems	•	0	0	0	•	0	•	3,4
,			Located less than 3 km from processing equipment site							•	1,0
			Located no more than 3 meters below the surface	0	0	0	0	0	0	0	0,7
,	Water		Accessible by automated systems		•		•			•	3,0
	Š		Potential for multiple sources of ice, ice/regolith mix and hydrated minerals	0	0	0	0	0	0	0	0,6
		Qualifying	Distance to resource location can be >5 km							•	1,0
ח :			Route to resource location must be (plausibly) traversable	•	•	•	•	•	•	•	7,0
,	Engineering		~50 sq km region of flat and stable terrain with sparse rock distribution	•	•	•	•	•	•	•	7,0
Ó	е т	Threshold	1-10 km length scale: <10°	•	•	•	•	•	•	•	7,0
	gin		Located within 5 km of landing site location							•	1,0
"	En		Located in the northern hemisphere								0,0
i	Civil	Qualifying	Evidence of abundant cobble sized or smaller rocks and bulk, loose regolith	?	?	?	?	?	?	?	0,0
	Ċ		Utilitarian terrain features	•	•		•	•		•	5,0
	nc		Low latitude								0,0
	od ctic	0	No local terrain feature(s) that could shadow light collection facilities	•	•		•	•		•	5,0
	Food Production	Qualifying	Access to water	•	0	0	0	•	0	0	2,5
	P		Access to dark, minimally altered basaltic sands	?	?	?	?	?	?	?	0,0
			Potential for metal/silicon	0	0	0	0	0	0	0	0,7
)	L		Potential to be minable by highly automated systems		•		•			•	3,0
•	Metal/Silicon Resource	Threshold	Located less than 3 km from processing equipment site							•	1,0
	Sil		Located no more than 3 meters below the surface	?	?	?	?	?	?	?	0,0
	etal/Silico Resource		Accessible by automated systems		•		•			•	3,0
	Met R		Potential for multiple sources of metals/silicon	0	0	0	0	0	0	0	0,7
		Qualifying	Distance to resource location can be >5 km							•	0,1
			Route to resource location must be (plausibly) traversable	•	•	•	•	•	•	•	7,0

ISRU and Civil Engineering Criteria

Key							
•	Yes						
0	Partial Support or Debated						
	No						
?	Indeterminate						

[in order of priority: addressing threshold first, then qualifying]

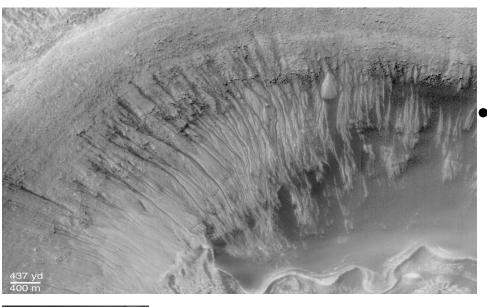
SCIENCE ROIS

Science ROI 1



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Image of SROI 1

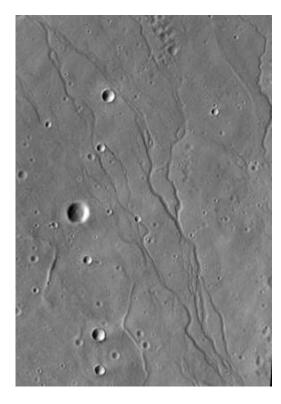


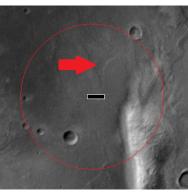
- 40.7° S / 200.3° E,
 altitude ~ -2 km, MOC,
 HiRISE
 - Visible gullies: Evidence of present aqueous processes -> Potential for present habitability/refugia



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Image of SROI 2





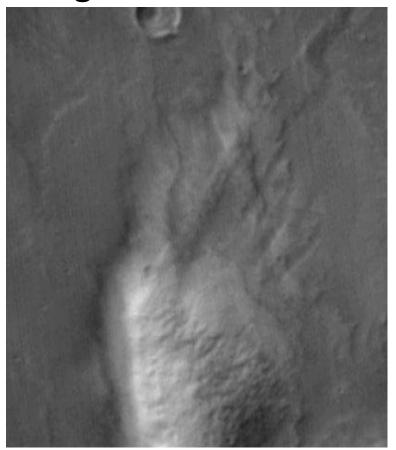
- 40.2° S / 200.8° E, altitude ~ -2 km, THEMIS
- Channels: Evidence of aqueous processes -> Potential for past habitability

Science ROI 3

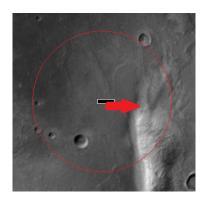


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Image of SROI 3



- 40.3° S / 201 E, altitude
 -2 km, THEMIS
- Bulge, probable sediment from aqueous processes -> Potential for past habitability





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Image of SROI 4



- 40.5° S / 199.6 E, altitude $^{\sim}$ -2 km, THEMIS
- Three craters of different age in the slide of the Newton Crater, revealing layers from different eras
 -> Potential for interpreting relative ages

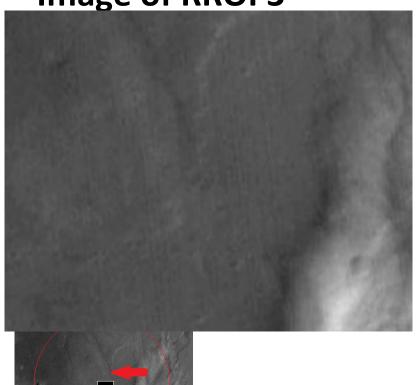
[in order of priority: addressing threshold first, then qualifying]

RESOURCE ROIs



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Image of RROI 3



- 40.4° S / 200.5 E, altitude ~ -2 km, THEMIS
- Channels: Evidence of aqueous processes -> Potential for ice or ice/regolith mix & potential for metal/silicon, located less than 3 km from processing equipment site and accessible by automated systems

Resource ROI 2

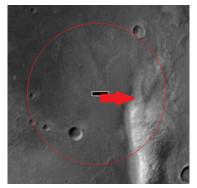


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Image of RROI 2



- 40.3° S / 201 E, altitude ~ -2 km, THEMIS
- Bulge, probable sediment from aqueous processes -> Potential for ice or ice/ regolith mix & potential for metal/silicon

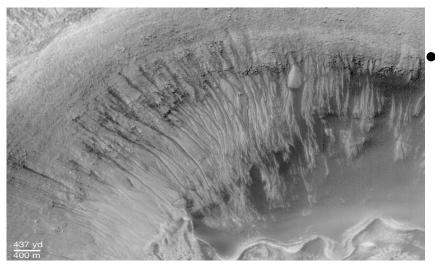


Resource ROI 1

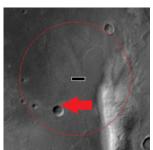


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Image of RROI 1



- 40.7° S / 200.4° E, altitude ~
 -2 km, MOC, HiRISE
 - Visible gullies: Evidence of present aqueous processes -> Potential for ice or ice/regolith mix for substantial production



RUBRICS



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- Science potential
 - Noachian/Hesperian rocks that have likelihood of containing trapped atmospheric gases: Only threshold criterion for Atmospheric Science
- Resource potential
 - Potential for usable metal/silicon: metal/ silicon concentration poorly known

BACKUP SLIDES



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- Orbiter/rover data to be collected to assess the science potential of the EZ:
 - More high resolution imaging (HiRISE) of EZ to assess all ROIs' threshold criteria
- Orbiter/rover data to be collected to assess the resource potential of the EZ:
 - More accurate gamma ray spectroscopy (GRS) to assess metal/silicon concentrations of resource ROIs